

34. (Cancelled)

35. (Cancelled)

#### REMARKS

In the Specification, the reference to the parent application of the present application has been amended to reflect the current status of the parent application, as an issued patent.

Also in the Specification, Paragraph [0038], which describes Figure 4 has been amended to reflect the time period actually shown on graph 400, which shows data out to 370 days. In addition, Paragraph [0113] has also been amended to recite the 370 days of time which are shown on graph 400.

Claims 19, 22, 25 - 27, 30, and 33-35 have been cancelled without prejudice, because the recitations in these claims are encompassed in other claims having broader recited ranges, and there is no particular advantage which is obtained over the particular ranges recited in these claims.

Claims 24 and 32 are objected to under 37 C.F.R. § 1.75(c) as being of improper dependent form for failing to further limit the subject matter of the previous claim. In fact, a portion of the subject matter of the previous claim had been further limited with respect to the number of hours of storage prior to use of the blank photomask substrate. With respect to the difference in CD, which must be what the Examiner is referring to, applicants' attorney did not intend that this nominal value be changed from that which was present in Claim 20, and the typographical error with respect to the CD recited in Claims 24 and 32 has been corrected.

#### Claim Rejections Under 35 U.S.C. § 112, first paragraph:

Claims 16 - 35 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The claims are said to contain subject matter

which includes range end points that were not supported by the original specification figures or claims.

Applicants' attorney has reviewed the application Specification in detail to determine the source of the limitations which were placed in the claims. With respect to the temperature range over which the post-apply bake was carried out, the range of 80 °C to 115 °C was based on Figure 5. Figure 5 shows that at the 88 °C PEB temperature which was used in Example 3, which pertains to the increased shelf life of a blank, photoresist coated substrate (Specification Page 33, lines 19 - 26, continuing through Page 34, to Page 35, lines 1 - 3), the change in CD on the finished mask structure remains within 20nm (between about 460 nm and about 480 nm) when the PAB temperature is between about 84 °C and about 118 °C. The Example 3 data had confirmed that a PAB temperature of 105 °C looked good (Specification, Page 34, lines 18 - 27, continuing at Page 35, lines 1 - 3). Because the precision of the limit is not known to within one degree, and the claims should not indicate a precision within one degree, the ends of the acceptable PAB range were rounded off. A more precise rounded off range would be "about 85 °C to about 115 °C". This would match the claimed temperature range more closely with the data in Figure 5. Applicants' attorney has amended Claim 16 to recite that the PAB temperature ranges between about 85 °C and about 115°C.

With respect to the recitation in Claim 16 that the blank, photoresist-coated substrate would be stable (within 20 nm) for a time period of "more than 2 hours" if the proper PAB baking temperature is used, the basis of this claim is Figure 3, which shows that prior to the discovery of the importance of PAB by applicants, the stability of a blank, photoresist-coated substrate (to provide a mask feature variation of less than 20 nm) was less than 2 hours. It is readily apparent from applicants' data that the blank, photoresist-coated substrate is stable from one day out to 370 days when applicants' PAB treatment is used. (Figure 4). Thus, the blank, photoresist-coated substrate continues to be stable from the time immediately after PAB out to 370 days. Applicants claimed "more than two hours" so that their claim would not overlap

the prior art stability time for blank, photoresist-coated substrates. In addition, applicants have amended Claim 16 to clarify the criteria used to determine whether a post-apply-bake falls under the scope of Claim 16. Support for this clarifying amendment is found in the application Specification as originally filed at page 34, lines 1 - 27, continuing at Page 35, lines 1 - 3.

Applicants contend that amended independent Claims 16 and 20 comply with the written description requirement with respect to the temperature end points of the PAB range and with respect to the stability time range which is claimed.

Claim 17 has been amended to replace the recitation of the AZ-Clariant DX 1100 photoresist with a description of necessary components known to be present in this resist. Support for this amendment appears in the Specification as originally filed at Page 34, line 19 in combination with Page 20, lines 18 - 20.

Claim 18 has been amended to recite a time period range for the PAB. Support for this amendment is present in the Specification as originally filed in Figure 3, combined with the text at Page 34, lines 1 - 5 which shows that a PAB at 90 °C for a time period of one minute was inadequate to prevent a radical change in the finished mask CD if the blank, photoresist-coated substrate was permitted to stand for even 1 hour prior after PAB prior to imaging. At the same time, we know from the data presented in Figure 5 and discussed above, that a PEB temperature as low as 84 °C for a time period of 7 minutes is adequate to prevent such a radical change in the finished mask CD. This shows that the instability problem was not due to the use of a 90 °C bake temperature; the problem was that a one minute bake time was too short. We also know from the Specification at Page 34, lines 18 - 21, that a time period of at least 9 minutes is not too long. From this we know that the PAB bake period must be greater than one minute and can be at least 9 minutes.

Claim 19 has been cancelled, without prejudice, because the storage period recited is included in the broader storage range period, as previously discussed with regard to other cancelled claims.

Independent Claim 20 has been amended in a manner similar to Claim 16, so that a proper temperature range for the PAB, as illustrated in Figure 5 is provided.

Claim 21 has been amended to recite the same time period range for the PAB, for the same reasons as those which were presented with respect to Claim 18.

Claim 22 has been cancelled without prejudice, as the recitation present in Claim 22 has now been included in Claim 21.

Claims 23 and 24 have been amended to more accurately reflect PAB temperature and time ranges discussed in the application, as discussed above.

Claims 25 - 27 have been cancelled, as previously discussed.

Claim 28, which depends from Claim 20, should be acceptable in view of the amendment to Claim 20.

Claim 29 has been amended to recite the same time period range for the PAB as recited in Claim 18 and Claim 21, for the reasons previously presented.

Claim 30 has been cancelled without prejudice, as the recitation in Claim 30 has been included in Claim 29.

Claims 31 and 32 have been amended to more accurately reflect PAB temperature and time ranges discussed in the application, as discussed above.

Claims 33 - 35 have been cancelled for the reasons discussed above.

Applicants contend that all dependent claims pending in the application after the present amendments comply with the written description requirement under 35 U.S.C. §112, first paragraph.

The Examiner is respectfully requested to withdraw the rejection of Claims 16 - 35 under 35 U.S.C. §112, first paragraph in view of the amendments and explanations presented above.

Claim Rejections Under 35 U.S.C. § 112, second paragraph:

Claim 17 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite, on grounds that Claim 17 contains a trademark/tradename. The Examiner argues that a trade name does not identify the goods. In the present instance, AZ-Clariant DX 1100, the trade name, does identify particular goods, a specific DUV photoresist material having a given composition. If AZ-Clariant designs a new photoresist material, that new material is given a new number, because its performance will be different, and customers must be able to rely on a constant performance from the photoresist which they order by the specific trade name. However, since the necessary and important components of this photoresist material are disclosed in applicants' Specification, Claim 17 has been amended to replace the recitation of "AZ-Clariant DX 1100 photoresist" with a description of necessary components known to be present in this resist. Support for this amendment appears in the Specification as originally filed at Page 34, line 19 in combination with Page 20, lines 18 - 20.

In view of the amendment to Claim 17, the Examiner is respectfully requested to withdraw the rejection of Claim 17 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim Rejections Under 35 U.S.C. § 102:

Claims 16 - 18, 20 - 21, 23 - 24, 28 - 29, and 31 - 32 are rejected under 35 U.S.C. § 102(e) as being anticipated by Montgomery et al. (U.S. Patent 6,605,394).

The Montgomery et al. patent pertains to a series of steps used to optically fabricate a photomask. The series of steps includes, at a minimum, applying an organic antireflection coating over a metal-containing layer; applying a chemically-amplified positive tone or negative tone DUV photoresist over the organic antireflection coating; and, exposing the surface of the DUV photoresist to radiation from a direct write continuous wave laser.

(Abstract and Claim 1, for example). The present invention pertains to a method of increasing the shelf life of a blank photomask substrate. (Title and Claim 1, for example). The present invention does not involve exposing the photoresist-coated substrate to radiation. The present invention pertains to increasing the shelf life of the blank photomask substrate prior to exposure to radiation. Applicants contend that their invention as claimed in independent Claims 16 and 20, and claims which depend from these claims, is not anticipated by the disclosure in the Montgomery et al. patent. The Montgomery et al. patent does not discuss or even suggest a method of increasing the shelf life of a blank photomask substrate.

To have anticipation of the presently claimed invention, the Montgomery et al. patent would need to describe application of the photoresist over a photomask substrate; a post application bake; and then storage of the blank photomask substrate for a period of time which would (based on the prior art) have caused a change in critical dimension of more than 20 nm. Applicants' attorney could find no description of this kind in the Montgomery et al. patent. The Montgomery et al. patent appears to be silent as to the length of time between PAB and exposure of the photomask substrate to radiation. The Examiner refers to Example 1 at Cols. 11 - 13, and refers to a less than 5 nm change in CD over a 6 hour time period. However, the text the Examiner refers to reads as follows at Col. 12, lines 29 - 31: "The latent image stability in the photoresist should be such that there is less than a 5 nm change in the CD over a 5 hour time period." The latent image referred to is the irradiated pattern which is present in the photoresist. This text refers to the stability of the irradiated pattern which resides as a latent image in the irradiated photoresist. This is distinguishable from the shelf life of a photoresist which has not been irradiated.

Applicants contend that the invention claimed in their application is not anticipated by the disclosure provided in the Montgomery et al. reference. The Examiner is respectfully requested to withdraw the rejection of Claims 16 - 18, 20 - 21, 23 - 24, 28 - 29, and 31 - 32 under 35 U.S.C. § 102(e) as being anticipated by Montgomery et al.

Claim Rejections Under 35 U.S.C. § 103:

Claims 16, and 18 - 35 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Tan in view of Capodieci.

Applicants respectfully contend that the disclosure in the Tan and Capodieci references alone or in combination does not render applicants' claimed invention obvious. The Tan et al. reference pertains to an interrupted development, multi-cycle development process, in combination with an aqueous photoresist developer composition which enables development of an electron-beam exposed novolak resin based on photoresists with resolution of less than 0.20  $\mu\text{m}$  (200 nm), contrast less than 5, and dark loss less than 10 %. (Abstract) The focus of the disclosure is on the photoresist developer composition. The photoresist discussed is a phenolic resin-based resist such as a DNQ/novolak resist system. (Col. 8, lines 14 - 19.) The DNQ/novolak resist system is substantially different from a chemically amplified photoresist comprising a modified phenolic polymer and an onium salt-containing chemical amplifier of the kind described and claimed by applicants. The Examiner mentions that Tan does not disclose that the soft baking process described ensures that a photoresist coated substrate may be stored a specific period of time. This coupled with the difference between the photoresist discussed in the Tan reference and the photoresist used by applicants clearly distinguishes applicants' invention from the subject matter disclosed in the Tan reference. There is nothing in the Tan reference which even suggests applicants' invention.

The Capodieci reference describes a system that simulates the physics of chemically amplified photoresist during bake processing after X-ray or ultraviolet exposure and before development. (Abstract) Applicants' invention pertains to shelf life of a blank photoresist coated substrate which has not been irradiated. Clearly, neither the Capodieci reference nor the Tan reference even suggest the subject matter of applicants' invention. Therefore, a combination of these references does not lead in the direction of applicants' invention.


The Examiner cites Capodieci as teaching that pre-baking will make a photoresist coated substrate solid and stable, but does not cite the location in the Capodieci patent at which this disclosure may be found. Applicants may have located the text to which the Examiner was referring at Col. 1, lines 1 - 34, which recites: "After coating (with photoresist), the wafers are pre-baked to make the photoresist solid and stable. Then, the pre-baked wafers are transported to an exposure station to transmit a latent image of a desired pattern into the resist film using a photomask either in proximity or projected onto the resist." The substrate in Capodieci is not a photomask substrate, it is a semiconductor wafer substrate. The photoresist is baked to make it solid and stable. This sounds as if the baking makes the liquid photoresist physically solid and mechanically stable upon the substrate surface. There is no indication that "stable" refers to stability with respect to ambient radiation. Further, the description sounds as if the wafers are transported directly from pre-baking to an exposure station for irradiation. There is no suggestion that the wafers are transferred to a storage area where they are held for a period of time prior to transfer to the exposure station. The photoresist described in the Capodieci reference is a chemically amplified photoresist, for example the APEX series resist produced by Shipley Company (Col. 1, lines 47 - 49) which employs a tert-butyloxycarbonyl (tBOC) chemical amplifier (Col. 1, lines 62 - 64, for example). This resist and chemical amplifier are distinctly different from the photoresist described in the Tan reference, and one skilled in the art will recognize that processing conditions should be distinctly different. One skilled in the art is unlikely to combine the teachings from these two references. However, even if the teachings are combined, applicants contend that the Tan reference and the Capodieci alone or in combination do not teach or even suggest applicants' invention.

In view of the distinctions discussed above, the Examiner is respectfully requested to withdraw the rejection of Claims 16, and 18 - 35 under 35 U.S.C. § 103(a) as being unpatentable over Tan in view of Capodieci.

Applicants contend that applicants' pending claims are in condition for allowance, and the Examiner is respectfully requested to enter the present amendment and to pass the application to allowance.

The Examiner is invited to contact applicants' attorney with any questions or suggestions, at the telephone number provided below, as applicants' attorney would like the opportunity to reach an agreement on what the Examiner considers to be allowable claims.

Respectfully submitted,

A handwritten signature in cursive script, reading "Shirley L. Church", is written over a horizontal line.

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